Flexible Micropost Arrays for Shear Stress Measurement

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Abstract:

The work is focused on developing a shear stress sensor for use in subsonic wind tunnel test facilities applicable to an array of test configurations. The novelty lies in the creation of micropost arrays with a low profile (nanoscale to 100μm) to stay within the viscous sub-layer of the airflow. Shear stress applied to the micropost causes post deflection that is visually detectable. Interrogation of the micropost array in real time will be correlated with pillar deflection calibration experiments to quantitatively measure shear stress as the micropost bends. Current shear stress measurement techniques suffer from reliability issues, complex instrumentation, and airflow disruption severely compromising resultant shear stress data. The proposed method is better because these shear sensors would provide a gapless, robust sensor with minimal packaging requirements and minimal or no disturbance of boundary layer flow. Compared to previous concepts, device installation can be simple, reducing cost and down-time. Ultimately, a reliable, accurate shear stress sensor that does not disrupt the airflow has the potential to provide high value data for flow physics researchers, aerodynamicists, and aircraft manufacturers leading to new, more fuel efficient airframe designs.